May 20, 1998

Magalie Roman Salas
Secretary
Federal Communications Commission
1919 M Street, NW 20554

In Re: WT Docket No. 96-86 - The Development of Operational, Technical, and Spectrum Requirements For Meeting Federal, State and Local Public Safety Agency Communication Requirements Through the Year 2010 Establishment of Rules and Requirements For Priority Access Service

Dear Ms. Salas:

This letter is being served on staff members of the Wireless Telecommunications Bureau in order to clarify some of the positions expressed by Motorola in comments filed in the above-referenced proceeding. As such, this letter should be included in the files of WT Docket No. 96-86.

This letter is intended to clarify Motorola's technical analysis concerning the ability of public safety land mobile stations to share spectrum in the 746-806 MHz bands with analog and digital broadcast television stations. The use of reasonable sharing criteria with TV broadcast stations will yield enormous benefits in terms of immediate availability of the newly allocated public safety spectrum.

Motorola's position is essentially reflected by the Commission in the First Report and Order of Docket 18261:[1]

> [T]he co-channel protection ratio we have adopted (50 dB) is, itself, a conservative one and when a 10 to 15 dB factor is added, due to the use of directional antennas with front to back ratios of this order, the effective protection will be from 60 to 65 dB at the assumed grade B contour of the protected UHF television facility. This, in our opinion, is an **ultraconservative** protection ratio.... (emphasis added)

More than 20 years of sharing experience has demonstrated that the existing sharing criteria are ultraconservative. In Motorola's analysis, taking into account additional sharing factors will continue to allow TV broadcasts to achieve high signal quality while providing public safety entities with access to spectrum that they clearly need.

In its comments filed in response to the FCC's *Second Notice of Proposed Rule Making,* Motorola emphasized the following key points regarding the co-channel[2] sharing criteria

[1] *First Report And Order*, Docket No. 18261, Released May 21, 1970, at ¶61.

with TV broadcasts in the 746-806 MHz band:

1. The Commission has already successfully implemented a 40 dB D/U sharing standard for land mobile and television broadcast stations in the New York City area. Given the lack of real-world interference, the 40 dB D/U ratio should be the basis for all land mobile/TV broadcasting sharing rules.

2. The frequencies in the 746-806 MHz band have greater propagation path losses than those in the 470-512 MHz band. Therefore, the required spacing between TV stations and land mobile stations in the new band should be reduced for the same land mobile ERP and/or the allowed ERP should be increased. Motorola's calculations show that this provides an extra 5.3 dB of protection to the TV receivers.

3. TV antenna front-to-back isolation ratios have well measured values across a variety of environments. This level of protection, too, should be included in the land mobile/TV broadcasting sharing rules. Motorola's information shows that 15 dB is a conservative, but reasonable, value to use for this effect.

Taking into account the above three factors, Motorola developed a table of land mobile transmitter to TV transmitter spacing requirements for specific powers and heights of the land mobile transmitter. This is shown as Table 1.

TABLE 1: BASE STATION MAXIMUM ERP (40 dB PROTECTION) FOR CO-CHANNEL SEPARATION INDICATED

	(40 dB PROTECTION) Maximum Effective Radiated Power (ERP)									
	Antenna height (AAT)									
DISTANCE*	50 ft. (15 m)	100 ft. (30 m)	150 ft. (45 m)	200 ft. (61 m)	250 ft. (76 m)	300 ft. (91 m)	350 ft. (106 m)	400 ft. (122 m)	450 ft. (137 m)	500 ft. 152 m)
90 mi. (145 km)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
85 mi. (137 km)	1000	1000	1000	1000	1000	1000	1000	1000	975	804
80 mi. (129 km)	1000	1000	1000	1000	1000	771	568	439	343	279
75 mi. (121 km)	1000	1000	870	516	348	246	179	138	110	89
70 mi. (112 km)	1000	561	261	146	94	64	47	36	29	24
65 mi. (105 km)	370	148	66	36	24	16	12	9	7	6

* Distance from the transmitter site of the protected NTSC UHF television station.

[2] Our adjacent channel interference recommendation, contained in section 5.4.3 of the Appendix attached to Motorola's comments filed on December 22, 1996, is achieved by applying these same factors.

An analysis incorporating the same effects was done for mobile and control stations, leading to a Table analogous to Tables C and D in 47 CFR §90.309. This is included here as Table 2.

Table 2 Mobile/Control Station ERP

DISTANCE FROM GRADE B		ERP OF MOBILE OR CONTROL STATION
MILES	km	
15	24	200
10	16	148
8	13	75
6	10	23
5	8	8
4	6	4
3	5	1

* Distance to mobile or control station.

Table 2 can be used to find the distance of the land mobile base station from the TV transmitter by adding together the TV station distance to the grade B contour, the spacing of the land mobile unit from the grade B contour, and the radius of coverage of the land mobile system in the direction of the TV transmitter.

As mentioned in Motorola's original comments, there are other considerations, that will improve the interference situation in practice.

1. Land mobile signals are typically vertically polarized, while TV receiver antennas are designed to detect horizontal polarization and reject vertically polarized signals, thus providing extra protection against interference from land mobile transmitters. This value can be on the order of 10-20 dB when measured against the main beam reception of the broadcast signal.[3]

2. The R-6602 propagation model for space and time variation was used to represent the land mobile signal interfering with the TV transmission. At the assumed grade B contour of 55 miles, the difference between the time model for 10% and 50% using the R-6602 curves is 13 dB. Our experience, as well as data from other sources, leads us to conclude that this is greater than is actually produced in practice. For instance, ITU-R recommendation ITU-R PN.370-6, shows this value as about 4 dB for propagation over land. The use of R-6602 results in a greater required spacing and, therefore, provides extra protection to the TV broadcasts.

[3] *See, e.g.*, ITU-R Recommendations 1994 BT Series Volume, Broadcast Service (Television), Rec. 419-3, *Directivity and Polarization of Antennas in the Reception of Television Broadcasting*, pp. 246.

3. Since the original sharing rules were promulgated, TV receiver technology has advanced resulting in better interference discrimination. Motorola has not, however, relied on these technological advances in these calculations.

4. In the case of mobile transmitters, it was originally assumed that all mobiles operate at an elevation of 100 feet above ground level. In fact, most mobiles operate at approximately ground elevation terrain with a distribution of a select few at greater heights and others below the mean ground level.

Benefits of Using Realistic Spacing Requirements

The attached Figure 1 shows the number of the top 50 U.S. markets that can take immediate advantage of the new public safety allocation as a function of the FCC's required spacing between co-channel land mobile base stations and TV broadcast transmitters. The most egregious case, for example, would be for the FCC to require a minimum separation between co-channel land mobile base stations and TV transmitters of "zero miles". In that hypothetical case, all 50 markets obviously would be able to take advantage of the new spectrum for public safety use. However, as the minimum required spacing between co-channel stations is increased, fewer market are able to use the spectrum for land mobile operations. Thus, as shown in Figure 1, there are only 18 cities for which a channel 63/68 or 64/69 pair can be found if the TV transmitters must be more than 260 km from the city center.

Figure 1 also illustrates the benefits of using more realistic spacing rules instead of the existing rules. We show in this figure the impact on the distance spacing for a 500 Watt base station at an elevation of 500 feet. The 50 dB D/U rules require a distance spacing of about 245 km, while the 40 dB D/U rules require a distance of about 190 km. Many large cities can not use the spectrum under these constraints. The realistic rules proposed by Motorola (i.e. also including propagation loss and TV antenna isolation adjustments) lead to a spacing of about 130 km. This spacing would allow several cities with large populations (New York, Los Angeles, Washington D.C, Philadelphia, Chicago) with a serious need for new public safety spectrum to access at least one pair of the new public safety channels.

A summary analysis of the benefit is shown in Table 3. In this table, we assume a typical base station to be 500 Watts and 500 feet AAT. A typical mobile station is assumed to be 50 Watts ERP. Data from Table 2 has been used to generate the spacing between the TV transmitter and the associated land mobile base station by adding together the grade B radius (55 miles) and the mobile station distance to the grade B as found in Table 2. No land mobile system coverage area has been included which allows us to say that *at least half, or more, of the following cities will be available for use by public safety in the new bands*. That is, we set the coverage distance of the land mobile station in the direction of the TV transmitter to be zero. (In order to make a fair comparison with the rules in 47

CFR 90.309, we have removed 30 miles from the distances listed in Tables C and D of these rules, which was the assumed land mobile system coverage radius.) Using Tables A-D of 47 CFR 90.309, and Tables 1 and 2 of this document, we show specifically what cities gain access (*over at least half, or more, of the city*) to the public safety spectrum as more realistic spacing criteria are assumed.

Table 3: Cities which benefit from the new public safety spectrum allocation as a function of the TV station protection criteria

500 W, 500 ft base station 50 dB protection TV Tx to LM base = 245 km 50 Watt mobile station 50 dB protection TV Tx to LM base = 169 km	500 W, 500 ft base station 40 dB protection TV Tx to LM base = 193 km 50 Watt mobile station 40 dB protection TV Tx to LM base = 137 km	500 W, 500 ft base station Motorola proposal TV Tx to LM base = 130 km 50 Watt mobile station Motorola proposal TV Tx to LM base = 100 km
63/68 or 64/69 public safety spectrum pairs available in: Dallas Houston Pittsburgh San Diego Minneapolis Saint Louis Phoenix Tampa Seattle Denver Kansas City Norfolk, VA Fort Worth San Antonio Portland, OR New Orleans Orlando Salt Lake City Nashville Memphis	Additional Cities with public safety pairs (in addition to those in column 1): Chicago Washington, D.C. Milwaukee	Additional Cities with public safety spectrum available (in addition to those in column 2) New York Philadelphia Nassau-Suffolk County Baltimore Cincinnati Columbus, OH Bergen County, NJ Charlotte, NC Hartford, CT Rochester, NY (Los Angeles at a slightly reduced power and/or antenna height)

This analysis demonstrates that, taking reasonable precautions to protect over-the-air TV broadcasts, it is still possible to provide immediate access to the new public safety

spectrum to many cities that desperately need the spectrum. Overly conservative rules used to protect TV broadcasts from potential interference by land mobile operations will not benefit viewers and will, on the other hand, be detrimental to public safety interests across the country.

We hope that this information is helpful to the Commission's deliberations. Please contact me at (202) 371-6940 if any further clarification is necessary.

Sincerely,

Leigh Chinitz
Manager, Telecommunications Strategy
Motorola, Inc.

Cc: John Clark
Kathryn Hosford
Herb Zeiler

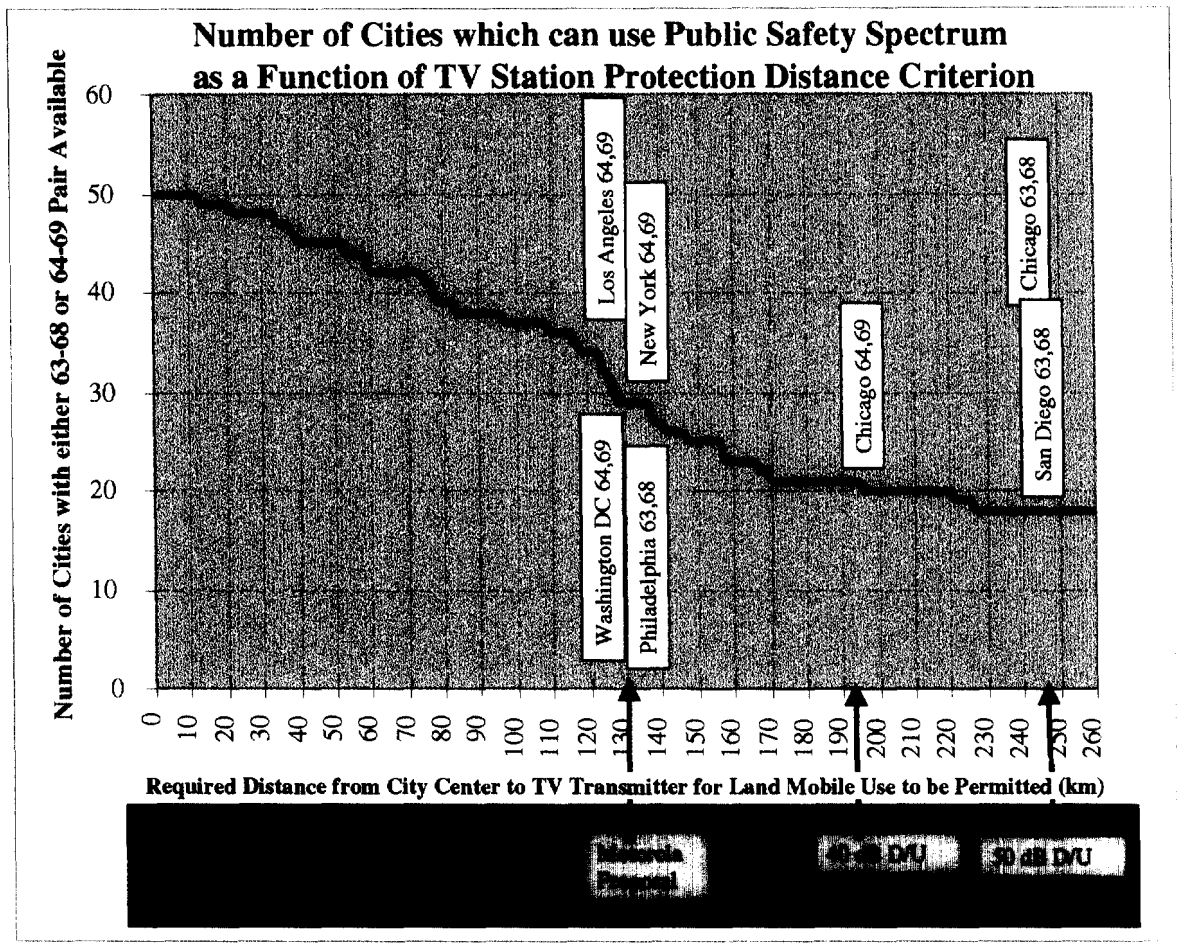

Figure 1: Number of cities which can take advantage of the 746-806 MHz public safety channels as a function of the TV spacing requirements